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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Primary and secondary contributions to aerosol light scattering and absorption in Mexico City during the MILAGRO 2006 campaign" *by* G. Paredes-Miranda et al.

G. Paredes-Miranda et al.

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Reply to reviewer comments for ACPD 8, 16951-16979, 2008, Primary and Secondary ...by Paredes-Miranda et. al.

The authors thank the reviewers for comments that were helpful for us in improving the revised version of the manuscript. Detailed comments from the reviewers, and our replies, are given below.

1. The role of BL dilution. It is easy to understand how BL dilution -the entrainment of clean air into the polluted BL- will change Babs and Bsca. However, it is hard for me to understand (from this paper) how BL dilution will change the SSA, which is an intrinsic property of individual aerosol particles, as it does not

depend on aerosol concentration. BL dilution is mentioned several times in the paper; for example, BL dilution is implied in altering the SSA on page 16959, line 13. Maybe I am reading too much into this section, but if I am not, then more clari64257;cation on the role of BL dilution is necessary. Also, see page 16958, line 24. I do not understand the statement that "the BL rise in the morning does not perturb the observations"; surely it must perturb Babs and Bsca. As the referee points out, the SSA of an individual aerosol particle is an intrinsic property of it, and thus, it cannot change with BL dilution. However, BL dilution may change the proportion of the different kind of aerosols and as a consequence it may modify the average SSA. We are assuming that BL height development and ventilation dilutes aerosol from primary sources as well as photochemically generated secondary aerosols, since the latter are being produced at larger rates than BC is emitted once the BL starts to grow during daylight hours. It is likely that secondary aerosols are generated throughout the whole volume of the BL, while primary emissions are generated only at the surface by sources. Since black carbon is more a light absorber than a light scatterer and has its source only in primary emissions, these processes would lead to a rise in the average SSA.

2. The paper only considers the fine mode aerosol. AERONET observations (e.g., Dubovik et al., 2002, Journal of the Atmospheric Sciences, 59, 590-608) taken at a site in Mexico City indicate a significant amount of the aerosol volume (mass) in the coarse mode (diameter > 2.5 um). My guess is that there will be too few particles in the coarse mode at the T0 site to influence the conclusions expressed in the paper. Is there anything the authors might do the reassure the reader that the coarse mode can be neglected? Maybe all that is possible is a flat statement that there is too little information about the coarse mode to consider it in this paper (and in any event, the S8201 effect of the coarse mode is probably small). There can indeed be a significant concentration of coarse aerosols (between PM2.5 and PM10) during dry periods due to the presence of dust e.g. see (Querol et al. 2008) and (Aiken et al. 2008), but these particles are not sampled by any of our

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instruments due to the size cuts of the inlets used. This was already discussed in our ACPD version (P16957 L28-29 to P16958 L4) with the following text: "It was estimated that the sampling inlets on the instrumentation resulted in an effective size cut of PM1 (i.e. one micron). The fraction of the PM2.5 mass between PM1 and PM2.5 in Mexico City is typically small (Querol et al. 2008; Salcedo et al. 2006), so slight differences in the detailed size cuts of the different instruments should only lead to small differences on the aerosols sampled".

3. Eqn.1 It seems to me that the numerator of Eqn.3 is expressed exactly as Bsca(Bsca,p/Babs)*Babs, where Bsca,p is the scattering of the primary aerosol. I am concerned how well the expression SSAp/(1 - SSAp) approximates the Bscat,p/Babs (where SSAp is the SSA attributed to primary sources). In other words, to what extent is Eqn.1 an approximation? I do not think this is a major issue but a little clarification would be useful. The main approximation in equation (1) is that secondary aerosol has a very strong influence on aerosol scattering, and a comparatively small influence on aerosol light absorption (Recent data from the project MEGALOPI in China suggests this as well). The approximation in equation (1) is commensurate with the notion that aerosol mass concentration is closely tied to aerosol light scattering in Mexico City as illustrated in Fig 5.

Technical comments:

1. Almost all papers dealing with the aethalometer seem to promote different spellings for this instrument. This paper is no exception, and in the paper "aethelometer" is spelled in three different ways. I think the correct spelling is "aethelometer", or so I hope... "Aethalometer" is now exclusively used.

2. Page 16953, line 5: I assume the emission values are daily values? Or monthly? "...generated yearly" was added to the text on this line.

3. The paper should spell out the time averaging interval for the optical properties. Maybe it is mentioned in the paper and I did not see it. All the reported

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optical data are averages of the measured values over 20 days in order to average over typical meteorological events. The introduction (page 16953 line 27) was modified to make this clear: These flow patterns give rise to pollutant concentrations that can vary markedly from day to day; however, it is the purpose of this paper to seek an understanding of the average diurnal behavior of aerosol concentrations and optical properties during the month of March, 2006.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 16951, 2008.